Section 5: Waste Contribution to the Mercury Environmental Burden

I. Introduction

This section focuses on the contributions of waste to the mercury emissions into the air, water and land. Information and data regarding waste-derived sources and their quantities into the air, water and land are presented in the first subsection, Mercury Anthropogenic Sources and Emissions. It is followed by an assessment of those mercury emissions in the following subsection, Mercury Environmental Burden Assessment. Waste combustion sources are emitted in significant quantities relative to California waste-derived sources. Identified water waste-derived mercury sources include legacy wastes, dentistry, and fluorescent lights. Land sources include disposal of mercury-containing products. A qualitative assessment of the quantities of waste-derived sources of mercury into the environment was done and it was estimated that

- 1.3 short tons of mercury from lamps would potentially be disposed in 2001.
- 1.51 short tons of mercury from waste-derived sources was emitted into the atmosphere in 2000.
- 0.4 short tons of mercury in auto shredder fluff were disposed in landfills in 2001.
- 118 pounds of mercury from dental offices exited the POTWs in 2000.
- 2.2 short tons of dental mercury were recycled or (land) disposed in 2000.

Although California agencies are working to reduce or control mercury emissions into the environment, mercury's mobility has continued to be an environment al issue, as evidenced by fish consumption advisories. DTSC is considering additional steps to control mercury emissions to land.

II. Mercury Anthropogenic Sources and Emissions

The following subsection focuses on the mercury contained in wastes, trends in waste mercury content, and the relative contribution of disposal of this waste to the total environmental mercury burden. Since the beginning of the industrial age, an estimated three-fold increase in the global environmental mercury burden has been attributed to human activities.[1] Mercury is mobile within and between air, water, and soils and is a public health and environmental concern. It follows that any steps that limit or control the amount of anthropogenic mercury entering the environment will yield benefits. This includes controlling the amount of mercury used as a raw material for industrial processes and consumer products through pollution prevention techniques, such as source reduction or substitution, or through indirect means, such as banning the sales of mercury-containing products, or imposing disposal restrictions of mercury-containing waste.

A. Anthropogenic Sources - Raw Material

1. Domestic Supply Trends[2]

An overall review of the supply of mercury is important in understanding the trends of its production and resulting release to the environment. In the USGS 2000 study of the materials flow of mercury from 1970 to 1998, Sznopek and Goonan identify "three

different time periods, each characterized by different market dynamics" were identified. The first of these periods lasted from 1970 to 1986. During this time, " . . .U. S., primary mercury mine production and net imports contributed significant amounts to the mercury market".

During the second period, which began in 1986 and lasted until 1992, the United States apparent mercury supply saw a rapid decrease, due in large part to the adoption of legislation to eliminate mercury in batteries. Battery manufacture accounted for 54 percent of the demand for mercury in 1984, but for only 2 percent of the mercury demand in 1992. During the same period, mercury was eliminated as a fungicide in paints. Fungicide use accounted for 16 percent of the demand from mercury in 1989; by 1992, it's accounted for none of the nation's demand. Apparently due to the dramatic drop in demand for mercury, the United States actually reversed the trend of large imports of mercury to become a net exporter of mercury beginning in 1989 and lasting through 1994. Mine production of primary mercury in the United States ceased in 1991.

The third period identified in the USGS 2000 Study lasted from 1993 to 1998. It was characterized "…by increases to cons umer and producer stocks, increasing net imports, no primary mine production, and greatly expanded secondary mercury production, supported by …legislat ion mandating mercury recycling".[3]

2. Domestic Consumption (Demand) Trends

Figures 5-1 and 5-2 are reproduced from the USGS 2000 Study. Weights are reported in metric tons in the two figures, but in the text of this report, all weights were converted to short tons for discussion purposes.* Figures 5-1 and 5-2 show the corresponding drop in mercury consumption during the late 1980s until the early 1990s.

* One metric ton equals 1000 kilograms, or 2200 lbs. One short ton (2000 lbs.) equals 0.907 metric tons.

Figure 5-1: U. S. Industrial Reported Consumption of Mercury (1970-1997)

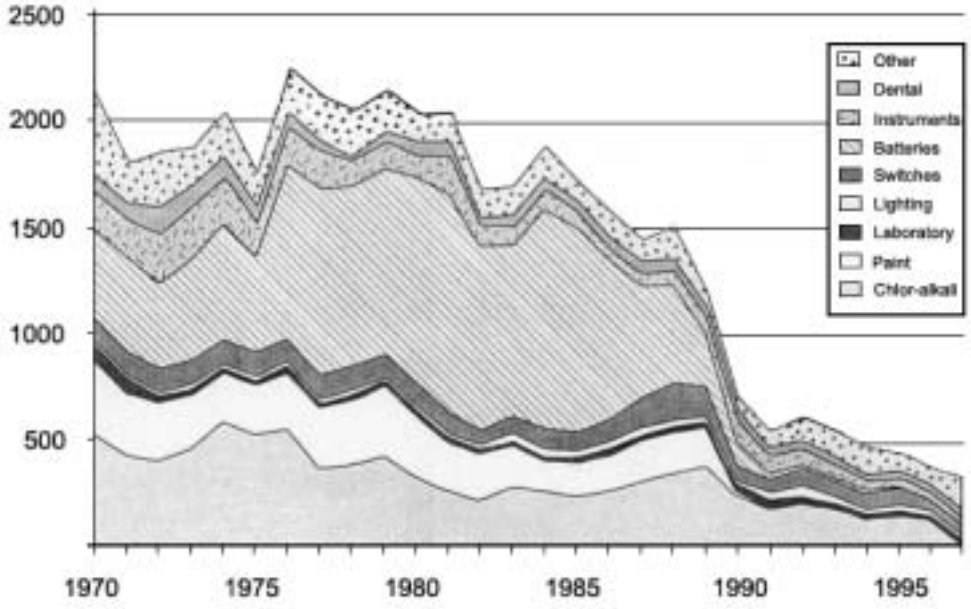

Figure 5-1 shows a steep drop of mercury consumption from the late 1980s through the early 1990s. This trend has continued, although the sharp downward slope has eased. The decrease in demand has been significant in most categories, except for dental, switches, lighting, and laboratory uses.

Figure 5-2: U. S. Apparent Supply and Reported Consumption of Mercury (1970-1998)

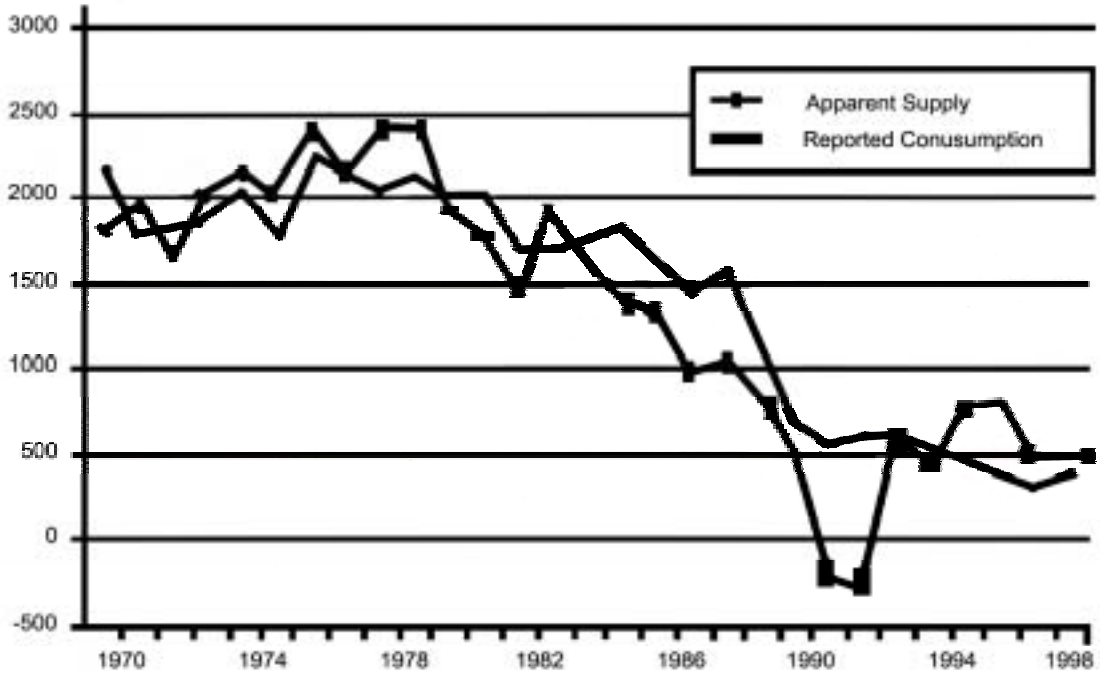

Figure 5-2 shows the corresponding supply and demand graphs for a similar period. The trend depicted in this graph supports the trend shown in Figure 5-1. The two figures show the United States consumed approximately 2200 short tons of mercury per year during the period from 1970 through 1986, then dramatically reduced its consumption to approximately 550 short tons per year between 1986 and 1992. The apparent supply closely follows the mercury consumption, except for the period during the early 1990s, when the United States was a net exporter of mercury.

The U.S. EPA 1997 Study has estimated domestic mercury consumption in 1989, during the second period identified in the USGS 2000 Study, to be 1336 short tons[4]. The U.S. EPA 1997 Study's estimate is in close agreement with the USGS 2000 Study's estimate for 1990: 1,354 short tons[5].

Figures 5-1 and 5-2 show that domestic mercury consumption dropped from more than 2426 short tons in 1976 to less than 441 short tons in 1998.[6] As the use of mercury continues to decline, mercury releases to the environment incidental to the manufacture, use, and disposal of products can also be expected to fall. Recent developments are likely to increase the downward trend in mercury consumption. For example, legislation introduced in 2001 is pending in many states that would effectively restrict the manufacture by prohibiting the sale of a certain mercury-added products (refer to Appendix A: Summary of Nationwide Mercury Efforts). The use of mercury in other products, including pesticides, mildewicides for paints, and many batteries, has already been eliminated.

3. Mercury Flow Trends[7]

According to the USGS 2000 Study, primary mine production of mercury fell from 494 short tons in 1990 to zero in 1996[8]. During the same period, secondary production of mercury increased to 492 short tons, more than four times the level in 1990. In 1990, the United States government sold 270 short tons of mercury from its stockpiles. United States government mercury sales were suspended in 1994 and have apparently not resumed. It appears that secondary mercury production has replaced primary mercury production.

According to the USGS 2000 Study, the total mercury flows to industry fell significantly. They were reduced from 784 short tons in 1990 to 410 short tons in 1996, as shown in Figure 5-2[9]. Figure 5-1 shows a decrease in the mercury flows to the following industrial sectors:

- dental (30 percent),
- laboratory (38 percent),
- measurement and control devices (62 percent),
- wiring and switches (30 percent),
- lighting (66 percent),
- batteries (100 percent), and
- chlor-alkali plants (45 percent).

The most dramatic decrease was mercury use in batteries, which went from 116 short tons in 1990 to virtually none in 1996.

B Air Emissions

Fossil fuel combustion emitted 84 short tons of mercury to the nation's air in 1996. Of this total, 73 tons were caused by the combustion of coal.[10] Oil and gas combustion for residential and non-residential space heating emitted 11 short tons into the air, while waste incinerators emitted 60 short tons.[11] The three main types of waste incinerators were: municipal waste combustors which emitted 30 short tons, medical waste incinerators which emitted 17 short tons, and hazardous waste combustors and cement kilns which emitted 12 short tons. [12] Table 5-1 displays these emissions.

Table 5-1: U.S. Mercury Emissions from Combustion Sources, 1996[13]

Source	Mercury Emissions (Short Tons)
Coal burning	73
Oil/gas combustion	11
Municipal waste combustion	30
Medical waste combustion	17
Hazardous waste combustion	12

In its 1997 report to Congress, U.S. EPA reported estimated United States mercury air emission rates for a number of source categories. Although they warn that their numbers are intended to be only estimates, U.S. EPA believes that "they …provide insights into the relative magnitude of emissions" from the different sources.[14] In each of the years 1994 and 1995, U.S. EPA reports that United States atmospheric mercury emissions totaled 158 short tons.[15] Of this total, "approximately 87 percent is from combustion point sources, 10 percent is from manufacturing point sources, 2 percent from area sources, and 1 percent is from miscellaneous sources". [16] Of the non-combustion sources, the largest national contributor was the chlor-alkali industry, which emitted 4.5% in 1994-1995. For the purpose of the U.S. EPA inventory, the nonhazardous waste incinerating Portland cement operations (3.1%) were counted as a manufacturing process. Pulp and paper manufacturing contributed 1.2%.[17]

Air releases from waste incineration decreased from 110 short tons in 1990 to 58 short tons in 1996. This was apparently due to a reduction in the amount of mercury contained in products as well as an increase in the efficiency of air emission controls.

Data collected by ARB and presented in Section 3 are summarized in Table 5-2 reflect those, which originate from traditional waste-derived sources totaling to 3023.17 pounds/year or 1.51 short tons/year.

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Table 5-2: California Waste-Derived Air Emissions for 2000

Waste-Derived Source	Mercury Emissions pounds/year
Cement Manufacturing	1730.45
Waste Burning (agricultural burning, open burning)	546.37
Fluorescent Tube Breakage	450.0
Incinerators (medical and municipal waste incinerators)	269.71
Sewage treatment	18.10
Cogeneration Plants	8.13
Landfills (gas collection systems, fugitive emissions)	0.38
Other (waste disposal)	0.03
	3023.17 pounds/year or 1.51 short tons/year

Although a direct comparison to national data cannot be done due to differences in sources and the differences in reporting requirements, a rough comparison was made with national waste combustion sources with California waste-derived sources. Nationally, waste combustion sources contributed to 59 short tons, while in California, the waste-derived sources contributed to 1.51 short tons. An estimate based on a 12% per capita the national combustion sources would have yielded an estimate of 7 tons of

air emissions, while the California air emissions for 2000 yielded 1.51 tons, significantly less. This difference may be attributed to the different years in which the national estimates were collected and compared. However, it is more likely that California has less medical and municipal waste incinerators, and no offsite hazardous waste incinerators. There are three onsite boiler/industrial furnaces that are permitted to burn hazardous waste, but one has not operated since it has been permitted by DTSC.

Mercury emission sources that were reported by the ARB in other source categories that emit more than 100 pounds of mercury per year include: geothermal sources, cement manufacturing, petroleum-related manufacturing, metal processes, general manufacturing , mineral processing, and electric services.[18]

C. Water Emission (Sources)

A large proportion of California's aquatic mercury burden originates from legacy waste from inoperative mercury and gold mines. As it is slowly mobilized from sediments, this 'legacy' mercury is carried from parent water bodies to the other water bodies into which they drain. Other sources of mercury into water bodies are atmospheric deposition, remobilization of historically polluted sediments through erosion, and wastewater discharges from point source discharges[19]. The mercury contained in waste can makes its way into California's waters by leaching and runoff from landfills, by atmospheric deposition, and via the sewer system.

It is suspected that in urbanized areas, dental amalgam may be a major contributor of mercury to wastewater that is treated by the POTWs. In a study conducted by the city of Palo Alto, it was found that in 2000, approximately 24 pounds of mercury entered the wastewater treatment plant, with about 20 pounds originating from dental amalgam (dental offices and human wastes).[20] Based on the information contained in the *Mercury Headworks Analysis for 2000* (Palo Alto Mercury Headworks 2000 Analysis) that was prepared for the Palo Alto Regional Water Quality Control Plant (RWQCP), 11.4 pounds per year enter the POTW for treatment from 170 dentists in the Palo Alto RWQCP service area.[21] Taking this data, 20,000 active dentist in California and 12% of the dentists do not use amalgam, an estimated 1,180 pounds of dental amalgam enters California's POTWs for treatment. POTWs mercury removal efficiency typically is 90%, resulting in discharges to water sources of 118 pounds in California.[22]

Abu-Saba, et al., in their *Watershed Management of Mercury in the San Francisco Bay Estuary: Total Maximum Daily Load Report to U.S. EPA*, June, 2000 (San Francisco Bay TMDL 2000 Report), has estimated that breakage of fluorescent light bulbs in landfills in their locale may contribute from 22 to 286 pounds per year as air emissions and deposits mercury into the San Francisco Bay[23].

D. Land Emissions (Disposal)

The USGS 2000 Study states that the amount of mercury disposed in landfills (excluding soil amendments) dropped from 832 short tons in 1990 to 325 short tons in 1996.[24] The U.S. EPA 1992 Study's estimate of landfill disposal of mercury in 1989 is in fair agreement with this figure. The U.S. EPA 1992 Study reported that in 1989, 709

short tons of mercury were discarded in municipal solid waste in the United States[25]. Summaries of the amount of mercury disposed are shown in Tables 5-3 and 5-4 below. The tables are reproduced from the U.S. EPA 1992 Study[26].

Tables 5-3 and 5-4 show U.S. EPA's projections of mercury discards for 2000, based on data collected from 1970 to 1989. Table 5-3 lists the contributions to mercury in the municipal solid waste (MSW) nationwide from each of the largest mercury-containing product categories; Tables 5-4 lists the relative contributions of each of these categories. The amount of mercury discarded in California for 2000, and the relative contributions of the various product categories in are estimated in Tables 5-3A and 5-4A; these tables are adjacent to Tables 5-3 and 5-4, respectively. As in Section 1, the calculated values in Tables 5-3A and 5-4A are based on the assumption that California's discards are representative of the nation's discards, and that the State's population represents 12 percent of the United States population.

Table 5-3: DISCARDS[1] OF MERCURY IN PRODUCTS IN THE MUNICIPAL SOLID WASTE STREAM 1970 TO 2000 (In short tons [2])[27]

Products	1970	1980	1989	2000 (Projected)
Household Batteries	310.8	429.5	621.2	98.5
Electric Lighting	19.1	24.3	26.7	40.9
Paint Residues	30.2	26.7	18.2	0.5
Fever Thermometers	12.2	25.7	16.3	16.8
Thermostats	5.3	7.0	11.2	10.3
Pigments	32.3	23.0	10.0	1.5
Dental Uses	9.3	7.1	4.0	2.3
Special Paper Coating	0.1	1.2	1.0	0.0
Mercury Light Switches	0.4	0.4	0.4	1.9
Film Pack Batteries	2.1	2.6	0.0	0.0
TOTAL DISCARDS	421.8	547.5	709.0	172.7

Table 5-3A

California 2000 (Per Capita Projection)*
11.8
4.9
0.1
2.0
1.2
0.2
0.3
0.0
0.2
0.0
20.7

[1] Discards before recovery.
[2] 1 Short Ton equals 2000 pounds
Source: Franklin Associates, Ltd.
* based on assumption that California's population is 12% of the national population

As shown in Table 5-3, U.S. EPA estimated that, in 1989, 709 short tons of mercury were discarded to municipal solid waste.[28] Batteries accounted for 87.6 percent (621.2 short tons) of this total and lighting accounted for 3.8 percent (26.7 short tons), as shown in Tables 5-3 and 5-4. [29]

Table 5-4: DISCARDS[1] OF MERCURY IN PRODUCTS IN THE MUNICIPAL SOLID WASTE STREAM 1970 TO 2000 (In Percent of Total Discards)[30]

Table 5-4A

	1970	1980	1989	2000 (Projected)	California 2000 (per Capita Projection)*†
Household Batteries	73.7	78.4	87.6	57.0	6.8
Electric Lighting	4.5	4.4	3.8	23.7	2.8
Paint Residues	7.2	4.9	2.6	0.3	0.0
Fever Thermometers	2.9	4.7	2.3	9.7	1.2
Thermostats	1.3	1.3	1.6	6.0	0.7
Pigments	7.7	4.2	1.4	0.9	0.1
Dental Uses	2.2	1.3	0.6	1.3	0.2
Special Paper Coating	0.0	0.2	0.1	0.0	0.0
Mercury Light Switches	0.1	0.1	0.1	1.1	0.1
Film Pack Batteries	0.5	0.5	0.0	0.0	0.0
TOTAL DISCARDS	100.0	100.0	100.0	100.0	12.0

[1] Discards before recovery.
Source: Franklin Associates, Ltd.
*assumption based on California's population is 12 % of the nation's population

Tables 5-4 shows that U.S. EPA projected changes in the relative contribution of batteries and lamps, the two largest categories of mercury-containing products, to the total amount of mercury in discarded products. U.S. EPA projected that the contribution of batteries to the total amount of mercury in MSW would significantly decrease: from 87.6% in 1989 to 57% in 2000[31]. U.S. EPA also projected that the contribution of the disposal of electric lighting would increase from 3.8% to 23.7% during the same period[32]. Taken together, batteries and electric lighting were projected to account for 80.7% of the mercury in discarded products in 2000. Based on per capita projections for batteries and electric lighting, California would be expected to have 9.7% of the nation's battery and electric lighting discards in 2000, which represents 16 short tons of mercury into California's landfills (See Table 5-3A).

In U.S. EPA's summary of mercury in discarded products, the contribution from fever thermometers and thermostats did not show signs of decreasing between 1970 and 1989, nor did U.S. EPA project significant reductions by 2000. The amount of mercury in discarded fever thermometers was 16.3 short tons in 1989 and was projected to be 16.8 tons in 2000[33]. The amount of mercury discarded in thermostats was 11.2 and

† California's contribution to the national mercury discharge.

10.3 short tons for the respective years[34] (see Table 5-3). Based on the previous assumptions, California would be projected to discard 3.2 short tons of mercury from fever thermometers and thermostats in 2000, representing 1.9% of the nation's total mercury discards (see Tables 5-3A and 5-4A).

The amount of mercury discarded nationally from light switches showed no change between 1970 and 1989, but was projected to increase to 1.9 short tons (1.1%) in 2000[35]. Similarly, the California estimate in 2000 would be 0.2 short tons entering California's waste stream and 0.1% of the nation's total mercury discards.

Mercury discards in MSW peaked in 1986 and are declining.[36] The U.S. EPA analysis agrees with the USGS 2000 Study's analysis in that a significant decrease was expected from batteries and paints. The U.S. EPA identified electric lighting and mercury light switches as the only mercury products with increasing quantities[37]. Taken together, the disposal of these two product categories was predicted to have contributed 24.8 percent of the total mercury discarded nationwide in 2000.

E. Fluorescent Lamp Data

The USGS 2000 Study reported that mercury content in fluorescent lamps shows a linear decreasing trend[38]. In 1990, the reported content was 46 milligrams per lamp, followed by 38 milligrams in 1991, 34 milligrams in 1992, 30 milligrams in 1993, 27 milligrams in 1994, and 23 milligrams in 1995[39]. The projected figure for 1996 was 19 milligrams per lamp[40]. U.S. EPA reported that the average fluorescent lamp had 75 milligrams of mercury from 1970 through 1984, as compared to 55 milligrams for lamps manufactured after 1985[41]. This data confirms the linear decrease in average mercury content from 1985 through 1995 that is seen in the USGS 2000 Study's data for the same time period.

Data cited by the USGS 2000 Study show a 35 percent decrease in mercury content in fluorescent lamps between 1985 and 1995[42]. However, calculations based on data from the USGS 2000 Study and the U.S. EPA 1992 Study show a much steeper drop: a reduction from 55 mg per tube in 1985 to 23 mg per tube in 1995, representing a 58% decrease. The San Francisco Bay TMDL 2000 Report cites data that commonly-used T8 fluorescent tubes contain approximately 10 mg of mercury each, while larger-diameter T12 tubes contain 21 mg per bulb, on average[43]. This indicates that the rate of the reduction in the mercury content of lamps may have slowed; technology may have reduced the mercury content of lamps to the point that further reductions would adversely affect lamp performance.

U.S. EPA estimates that 26.7 tons of mercury was disposed in electric lighting in 1989[44]. Assuming that California's lamp usage and disposal patterns are proportional to national usage and disposal, and considering that California's population is 12% of the national population, it is estimated that California discarded 12% of the 26 tons, or 3.1 tons of mercury to MSWs from lamps in 1989. Based on information provided by the National Electrical Manufacturer's Association, the approximate amount of mercury originating from fluorescent lamps that will impact California in 2001 will be 2686 pounds or about

1.34 short tons.[45] This is about 45% less than the 2000 estimate of 4.9 short tons projected in Table 5-3A. The 2001 estimate is based on the number of lamps sold in 1996 with an estimated 16 milligrams of mercury and based on a five-year life expectancy.

F. Dentistry

The use of mercury in dental amalgams is being seriously debated worldwide. Governments that have taken steps towards eliminating or limiting amalgam use include Sweden, Germany, Denmark, Norway, Finland, Canada, and Austria.[46],[47],[4849] "In California, state law requires a disclosure form signed by all patients who are going to have fillings, letting them know that their dentist is about to put a controversial material in their mouth. Other states are introducing similar legislation."[50] However, national data in Table 5-3 show that mercury discards to MSW from dental uses are declining. In 1989, 4.0 short tons were disposed; U.S. EPA projected that 2.3 short tons would be discarded to MSW in 2000.[51] Using these figures to project the same data in California, California dentists would have contributed 0.48 short tons (960 pounds) in to MSW in 1989 and estimated 0.28 short tons (560 pounds) in 2000. California's dental amalgam waste is projected to have contributed 0.2 percent of the nation's total mercury discards in 2000.

Based on information contained in the *Mercury Headworks Analysis for 2000* that was prepared for the Palo Alto RWQCP, an average of 0.45 grams per day of dental amalgam scrap is captured by dental offices in chairside traps, vacuum screens, or other capture method.[52] Using again that there are 20,000 active dentist in California and 12% of the dentists do not use amalgam, there were 2.2 short tons of dental mercury that was disposed or recycled in California in 2000. The California quantity is based on dental mercury generated rather than land disposed and although not directly comparable, this quantity is greater than the projected estimate for 2000 that would have been disposed to California landfills.

G. Data Limitations

The air and land emissions reported in 1996 from the USGS 2000 Study's data and the U.S. EPA 1992 Study's data are applicable to the United States as a whole. The U.S. EPA 1992 Study cautioned that the data should not be construed to be representative of mercury in MSW in a particular locality, as there are variations in waste composition and waste management practices[53]. The report also cautioned that the estimates are often based on assumptions. The U.S. EPA 1992 Study also excluded a number of nonhazardous wastes (municipal sludges, oil and gas production wastes, and mining wastes, for example) from their calculations.

The U.S. EPA 1997 Study report acknowledged that there are "considerable uncertainties regarding the levels of natural and re-emitted mercury emissions."[54] This makes "an assessment of the relative public health and environmental impact that can be attributed to current anthropogenic emissions…(very) complicated…."[55] U.S. EPA's external review panel estimated that the missing sources from its report could contribute as much as 20 percent more mercury emissions to the United States total[56]. However,

the U.S. EPA 1997 Study's estimate compares favorably (within 10%) with two other studies done for 1990, and the 1994-1995 national baseline study

Similarly, some of the California estimated projections will have uncertainties as they were calculated based on 12% of national data, a per capita basis, and the assumption that California's consumption and discards is on representative of the nation. When California specific data were available, these were included for assessment purposes.

III. Mercury Environmental Burden Assessment

The data presented above indicate that mercury's use as a raw material is declining, as shown by the decreases in supply and demand of mercury. This is attributed to declining mercury uses in industry and products resulting from regulatory efforts to limit or decrease mercury uses. Secondary production (recycling) has completely supplanted primary production of mercury from ore, and appears to be adequate to meet the reducing demand for the metal. There are, however, existing stockpiles of mercury as a raw material that may become a long term storage or disposal issue when the supply greatly surpasses the demand for mercury.

Nevertheless, it follows that if there is a declining usage of mercury in industry and products containing mercury, there will be a downward trend in the amount of mercury-containing waste entering the land from direct disposal. Additionally, as future regulatory efforts to control and decrease emissions to air (air pollution control devices), water (Clean Water Act and TMDL efforts), and land disposal (hazardous waste treatment before land disposal) continues, the mercury industry and consumers will be considering the cost effectiveness of the continued use of mercury.

While the use of mercury has continued to drop, it is clear that the environmental mercury burden remains unacceptably high. Past activities have mobilized mercury in the environment, where it persists and continues to pose risks to public health and the environment. This fact is evidenced by numerous sport fish consumption advisories issued in California and in other states, by the mercury-contaminated sites that require mitigation, and by the numerous legislative and regulatory efforts to reduce the amount of mercury that enters the environment through out the nation and in California (see Appendix A: Summary of Nationwide Mercury Efforts).

A. Air and Water Waste Burden Assessment

Air emissions from anthropogenic sources are decreasing, due not only to decreases in industrial uses, but due to increased efficiency of air pollution control devices. The latter factor has been driven by statutes and regulations, such as the California's Air Toxic "Hot Spots" program that are intended to reduce air pollution with toxic substances. Nationally, the mercury contribution from waste combustors (municipal, medical, and hazardous waste combustors) to air emissions in 1996 was 60 short tons while in California, the 2000 mercury waste-derived source emissions were 1.51 short tons[57].

Controlling mercury entering water sources continues to pose a challenge as indicated by efforts in the San Francisco Bay TMDL 2000 Report and the Palo Alto Mercury Headworks 2000 Analysis. Point source waste water discharges from industry and POTW, although controlled, are suspected to contribute to the mercury deposition in the Bay and cause impairment to the waters and water sediments, which ultimately result in mercury fish consumption advisories. Other statewide efforts to address mercury in the water bodies are in the initial stages (for example, Central Valley Regional Water Quality Control Board's TMDL for Clear Lake).

The San Francisco Bay TMDL 2000 Report notes efforts to estimate the amount of mercury from lights from breakage at the landfill, which may contribute to the bay's mercury loading through atmospheric deposition. The report suggests that partnerships with manufacturers to further reduce mercury in lighting or efforts to ensure 100 percent recycling instead of landfill disposal as two possible mechanisms to reduce atmospheric mercury emissions. Another suspected source of mercury in the San Francisco Bay is dental amalgam waste. Mercury has been found in POTW effluents, in spite of the fact that the influent waste is extensively treated prior to discharge, attaining effluents with mercury concentrations from 5-7 ng/L in advanced treatment plants to 15-25 ng/L in secondary treatment plants. While mercury removal is efficient, a better strategy is to reduce the potential 1180 pounds of mercury influent as much as possible with mercury alternatives as discussed in Section 4 or pollution prevention techniques, such as additional mercury traps. The resulting mercury reduction entering the POTWs will reduce the effluent after treatment.

Another major source of mercury contamination noted in the San Francisco Bay TMDL 2000 Report is legacy waste from past mercury mining. The report states that, in order to achieve the proposed TMDL goals, all efforts, to reduce introduction of mercury in the bay will be needed, including increased current efforts.

California's waters are under the regulatory authority of the California State and Regional Water Quality Boards. Efforts to control the discharges into sewers and POTWs are a joint effort of the State and Regional Water Quality Control Boards, DTSC and their delegated local implementing agencies.

For instance, as noted in San Francisco Bay TMDL 2000 Report and the Palo Alto Mercury Headworks Analysis, amalgam and fluorescent lights are considered sources of mercury in the Bay and in wastewater. DTSC oversees the management and disposal of amalgam waste and most mercury-containing fluorescent tubes. Amalgam waste from dental offices is considered hazardous waste and most dental offices recycle the waste amalgam under the scrap metal exemption. However, it has recently come to DTSC attention that during the processes that generate the amalgam waste during dental operations, small amounts enter the POTW system from each dental office, totally at an estimated at 1180 pounds of mercury from California dentists. Each dental office may contribute insignificant amounts of amalgam into the POTW, but the amount of dental offices in the area may add up to a significant amount of mercury

entering the POTW. As noted in the Palo Alto Headworks Analysis, about 80% of mercury entering wastewater treatment originate from dental amalgam sources.[58]

In like fashion, most fluorescent tubes currently contain mercury in concentrations that are considered hazardous waste and must be managed accordingly. However, as manufacturing industry progresses and the mercury concentration in lighting is reduced to the point that the lighting waste is below the hazardous waste threshold, the consequences may equate to a significant source of mercury to air, water and land. That is, the quantity of lighting waste, along with their reduced concentrations of mercury to nonhazardous waste levels, may add up to a significant amount of mercury, adding to the total mercury burden in air and water, as well as to their impact to direct land contamination, which is discussed below.

B. Land Burden Assessment

Since the mid 1980s, appropriate land disposal of mercury-containing waste has been determined by an assessment of the hazardous waste identification criteria, whether a federal "listed" hazardous waste, or a mercury characteristic waste by the TCLP, WET, or TTLC. If the mercury in the waste is determined to be a hazardous waste, the land disposal is controlled, as well as it s storage, transportation, treatment, and recycling. The oversight of this regulatory scheme falls within DTSC.

However, not all waste falls within this regulatory scheme and under DTSC. For instance, a waste may meet hazardous waste criteria, but be exempt from regulation by DTSC because of a statutory or regulatory exemption.

In evaluating the wastes that are under the authority of DTSC as discussed in the Land Emissions (Disposal) of this section, many of the wastes meet current hazardous waste identification criteria and must be managed in accordance to requirements for hazardous waste. This includes the estimated projection of 20 short tons of mercury. These include switches, batteries, and thermometers, paints and most mercury-containing electric lighting. The mercury discards in Table 5-3 and 5-4 are managed as hazardous wastes in California and should not be entering Class III landfills. As a general statement, most consumer product wastes with little or light housing may be a hazardous waste since the mercury concentration in the product would be distributed over the total weight of the waste. For instance, mercury in paints would be considered a hazardous waste, but if the mercury–paint was on wood debris, the concentration of mercury may not be sufficient in relation to the total wood waste to be considered a hazardous waste for controlled management and disposal.

Wastes that may be nonhazardous or is expected to be nonhazardous are those wastes that exist in large or heavy housing or in equipment where the mercury cannot be removed or is difficult to remove. Examples of these types of wastes are measuring equipment, such as manometers or barometers which are made with heavy and/or large housing and where the mercury measuring device is securely housed that dismantling is difficult; toys, games, novelty items with embedded mercury batteries or switches; and cars containing mercury switches. Because the California hazardous waste criteria is

based on WET-soluble and total concentrations, the mercury is "diluted" with the housing and may be determined to be nonhazardous for disposal.

In California law, appliances are diverted from disposal in Class III municipal landfills and are recycled for their scrap metal. This law also requires that mercury switches/devices be removed before recycling the metal. Currently, the law does not apply to automobiles, which are also recycled for their metal. Consequently, non-ferrous waste generated from shredding automobiles is contaminated with mercury, but is “diluted” to nonhazardous waste concentrations due to the large mass of each automobile. If mercury switches were removed before shredding automobiles and properly managed as a hazardous waste, a significant amount of mercury could be diverted from Class III landfills.

DTSC’s Auto Shredder Initiative has estimated that 700,000 automobiles are shredded in California each year. Each car has two mercury switches, containing an average of 500 and 1000 mg of mercury each[59]. Assuming that none of these switches are currently removed prior to disposal, and the amount of mercury disposed to non-hazardous waste landfills via auto shredder waste, a mixture of appliance and automobile shredder waste, is between approximately 0.75 and 1.5 short tons. The DTSC Auto Shredder Initiative sampling effort has shown that there is 300,000 tons of auto shredder waste with a total of 0.93 short tons of mercury. Of the 0.93 tons of mercury, it is estimated that 0.4 short tons originated from automobiles (47% of the shredding operation are from automobiles) with an undetermined amount being emitted to the air during storage or during the shredding operation.

Information from “nonhazardous” fluorescent lamps is limited. It is estimated in 2001 that California will have a disposed of potentially 1.34 short tons of mercury from all fluorescent lamps.[60] DTSC has received anecdotal information indicating that 25% of the mercury lamps disposed in California are “nonhazardous” fluorescent lamps; however, confirmation of this information is needed.

Suspected "nonhazardous" waste, such as, toys, games, novelty items, nonhazardous electrical lighting waste, measuring equipment, and painted debris, etc., enter a Class III municipal landfill. Nonhazardous waste treatment, storage, transportation and disposal requirements are not the same as hazardous waste requirements. This may cause potential for mismanagement occurrences during their handling, storage, transportation, and disposal, which may result in potential breakages, spills, and leaks to the land and air. Small quantities of mercury spills and leaks during handling and storage may cause direct land contamination over time. This may result in a contaminated site, which may require clean up to protect public health. Mercury air emissions due to breakage, spills, and leaks are uncontrolled and cause an incremental increase in the inhalation hazard. Mercury may enter the water due to breakage, spills, leaks and improper storage or disposal and enter storm drains and ultimately the open waters. The quantities of these wastes are unknown at this time; however, there has been an incident involving a contractor lighting change out and dumpster disposal, which resulted in many fluorescent lights broken near a storm drain[61].

Clearly, as much as California has controlled mercury releases to air, water, and land, to protect public health and environment, the mercury burden and its mobility to travel between environmental media, is still an environmental issue as evidenced in water pollution and fish consumption advisories. Additional controls are necessary to protect public health and environment. Currently, it is easier to dispose of mercury-containing waste rather than recycling the waste and there is no incentive to recycle. Water agencies are considering additional measures to protect California's water from mercury sources in their TMDL effort. California legislation in 2001 has been introduced to ban sales of mercury-containing products in California as well as "encourage" the removal of mercury light switches in automobiles. Nationwide and state mercury organizations exist to address mercury in the environment.

California agencies overlap and affect each other's primary responsibility in protecting public health and environment in regards to mercury in our environment. Each agency is charged to protect public health and environment to the extent their regulatory authority allows them. The California Environmental Protection Agency has charged these agencies to work in cooperation with each other, to address public health and environmental issues. As such, to provide additional safeguards, encourage pollution prevention and promote recycling, DTSC is considering recommending that all mercury-containing waste be considered hazardous waste.

Section 5 Key Points:

- An estimated three-fold increase in the global environment mercury burden has been attributed to human activities.
- From 1970 to 1986 U. S. conducted mercury mine production and imported mercury.
- From 1986 to 1992 mercury supply and use is decreased and the United States exported mercury.
- From 1993 to 1998, the United States does no primary mercury mine production and uses secondary production of mercury to meet its supply needs.
- Domestic mercury consumption dropped from more than 2426 short tons in 1976 to less than 441 short tons in 1998.
- Fossil fuel combustion emitted 84 short tons of mercury to the nation's air in 1996, with waste incinerators emitted 60 short tons.
- California's air emissions from waste-derived sources are 1.51 tons in 2000.
- The ARB estimates that 450 pounds of mercury air emissions were derived from broken fluorescent tubes.
- In 1994 and 1995, approximately 87 percent of the nation's atmospheric mercury emissions were from combustion point sources.
- A large proportion of California's aquatic mercury load originates from legacy waste from inoperative mines.
- An estimated 22 to 286 pound per year from fluorescent lights potentially enters the San Francisco Bay.

- The USGS estimated that the amount of mercury disposed in landfills dropped from 832 short tons in 1990 to 325 short tons in 1996.
- Household batteries and lighting comprise the majority of the discards of mercury in products in the municipal solid waste stream from 1970 to 2000.
- U.S. EPA's study showed that the mercury contribution from fever thermometers and thermostats did not show signs of decreasing between 1970 and 1989. No significant reductions were projected by 2000.
- The mercury content in fluorescent lamps has decreased significantly since 1985 to 1995 and is slowly decreasing, indicating that further decreases in mercury will affect lamp life.
- U.S. EPA estimates that 26.7 tons of mercury was disposed in electric lights in 1989.
- California estimates that 1.3 short tons of mercury from fluorescent lamps will be disposed in 2001.
- California dentists generated an estimated 2.2 tons of mercury from dental amalgam that was disposed or recycled and 118 pounds of mercury from dental offices exited the POTWs into water ways.
- While the use of mercury has continued to drop, the environmental mercury load remains unacceptably high. This is evidenced by numerous sport fish advisories, by the mercury-contaminated sites, and by the numerous legislative and regulatory efforts to reduce mercury contamination.
- Anthropologic mercury air emissions are decreasing from decreases in industrial uses and air pollution control devices.
- Mercury has been found in POTW effluents despite extensive influent treatment.
- Automobiles contribute approximately 0.75 to 1.5 short tons of mercury to nonhazardous waste landfills per year through auto shredder waste.
- Of the 0.93 tons of mercury from Auto Shredder Waste, it is estimated that 0.4 short tons originated from automobiles.
- Promote pollution prevention and recycling to provide additional safeguards from mercury environmental loading by regulating all mercury-containing waste as hazardous waste.

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Section 6: Options to Reducing the Amount of Anthropogenic Mercury Released to Land

I. Introduction

Encouraging pollution prevention, recycling, and promoting the use mercury alternatives to provide additional environmental and public health safeguards will be accomplished by redefining the hazardous waste identification criteria for mercury. DTSC is considering recommending "listing" all mercury-containing waste, regardless of source, as hazardous waste; the use of universal waste management standards for waste types or products where they are most applicable; Class I landfill disposal; and phased implementation to allow time for mercury-containing product substitution using mercury alternatives, any needed infrastructure development and compliance. This section identifies the hazardous waste identification and management options DTSC may consider regarding regulating nonhazardous mercury-containing waste (under the current hazardous waste classification scheme) as a hazardous waste.

II. Background

Both federal U.S. EPA and California promulgated the current hazardous waste identification regulations in the mid-1980's, under the authority of the Resource Conservation and Recovery Act (RCRA) and Hazardous Waste Control Law, respectively. Two systems of hazardous waste identification existed in California, the federal and state systems until the early 1990's when California became authorized by U.S. EPA to implement the federal hazardous waste regulations through one set of regulations, Title 22, California Code of Regulations (22 CCR). These regulations identify RCRA wastes (federal identified hazardous wastes) and nonRCRA wastes (California identified hazardous wastes) and sets management standards for both RCRA and nonRCRA hazardous wastes.

RCRA wastes are identified by lists of hazardous waste (F, K, P, and U wastes) and characteristics (ignitable, reactive, corrosive, and toxic), while nonRCRA wastes are identified by characteristics only. One of the basic differences between RCRA and nonRCRA hazardous waste identification schemes is that California does not recognize many of the federal waste exclusions and exemptions. One federal exclusion that California has adopted is the mining waste exclusion found in Section 66261.4(b)(5), 22 CCR and Section 25143.1, Health and Safety Code (HSC). Hazardous waste identification criteria that are applicable only to nonRCRA hazardous wastes are solid corrosives; toxic characteristics identified by aquatic toxicity, lethal dose data, additional persistent and bioaccumulative chemicals; a different leaching test, the WET rather than the TCLP; and TTLCs. Those wastes, which are excluded or exempted under RCRA and not adopted by California, are subject to regulation as a nonRCRA waste if they meet a characteristic of a nonRCRA hazardous waste.

Mercury is a hazardous waste if the waste meets a federal RCRA listing or is characteristic by the TCLP, STLC, or TTLC. When the regulations were adopted in the mid-1980s, safety factors were considered and regulatory threshold levels were set to be protective of public health and environment. Yet, as evidenced by this report,

mercury continues to bioaccumulate into fish tissue, which results in fish consumption advisories, various mercury species has have been detected in municipal landfill gas, and in municipal landfill leachate, indicating additional efforts are needed to control mercury emissions.[1,2,3] Although it may be debated that the waste contribution to the total mercury environmental burden is relatively small, DTSC is considering ways to promote recycling and pollution prevention within the hazardous waste regulatory framework and reduce mercury emissions into California's environment

III. Hazardous Waste Identification Options

A. Waste Types and Products

Table 6-1 below lists the waste types or products that are currently identified as hazardous mercury-containing waste by the current hazardous waste identification criteria and wastes types or products that might also be identified as hazardous waste.

Table 6-1 Waste Types / Products

Waste Type/Consumer product	Current Mercury Hazardous Waste Identification Status	Waste Characterization Issues	Affected by Options for Revising Hazardous Waste Identification
Thermostats	- Hazardous - Exceeds TTLC		No
Batteries	- Hazardous - Exceeds TTLC		No
Thermometers	- Hazardous - Exceeds TTLC		No
Lamps	- Hazardous - Exceeds TTLC		No
Lamps	- Nonhazardous		Yes
Toys, Games, and Novelty Items containing mercury	- Expected to be Nonhazardous	- Mercury is "diluted" with the weight of the toy, game, novelty item, etc. to current "nonhazardous" levels	Yes
Mercury Switches/Pivots	- Hazardous - Exceeds TTLC		No
Other Mercury Measuring Instruments (barometers, manometers, etc.)	- Nonhazardous	- Mercury is "diluted" by the heavy equipment housing to current "nonhazardous" levels	Yes
Dental Amalgam Scrap	- Hazardous - Exceeds TTLC for mercury and silver	Exempted as scrap metal if recycled	No
Dental Amalgam Fines	- Hazardous - Exceeds TTLC for mercury and silver	- Recently clarified as a regulated hazardous waste - Dental amalgam fines are typically not caught by special traps and are being discharged to POTWs	No
Paint, Pesticides, Pharmaceuticals	- Expected to be Hazardous - Expected to exceed TTLC or		No

Waste Type/Consumer product	Current Mercury Hazardous Waste Identification Status	Waste Characterization Issues	Affected by Options for Revising Hazardous Waste Identification
	STLC		
Mercury-painted debris	- Expected to be nonhazardous	- Mercury concentration is "diluted" with the weight of the building debris (wood, sheetrock, etc.)	Yes
Automobiles with Mercury Switches - On the Governor's desk: Senate Bill 633, effective on January 1, 2002, the removal of mercury switches are encouraged before shredding operations to recover metal	- Nonhazardous	- The mercury concentration is "diluted" with the weight of the automobile.	Yes
Appliances ("White Goods") with Mercury Switches - Removal of mercury switches is required before shredding operations to recover metal	- Nonhazardous	- The mercury concentration is "diluted" with the weight of the appliance. - Removed mercury switch is hazardous waste	Yes
Auto Shredder Waste (a mixture of white good and automobile waste after metal recovery)	Nonhazardous for mercury	- Auto Shredder Waste exceeds hazardous waste criteria but was reclassified as nonhazardous waste under Section 66260.200(f), 22 CCR	Yes
Ash	Hazardous -Exceeds TTLC or STLC for inorganics		No
Ash	Nonhazardous *	- Analytical data of nonhazardous ash is limited	Yes
Sewage Sludge	Hazardous -Exceeds TTLC or STLC for inorganics		No
Sewage Sludge	Nonhazardous*	- Analytical data of nonhazardous sewage sludge is limited	Yes
Contaminated Soil	Hazardous		No
Contaminated Soil	Nonhazardous*	- Analytical data of nonhazardous soils is limited	Yes
"Old" Legacy Mining Waste	- Not regulated under HWCL or RCRA - Waste was generated prior to	- May be cleaned up under Federal and/or State Superfund authorities	No

Waste Type/Consumer product	Current Mercury Hazardous Waste Identification Status	Waste Characterization Issues	Affected by Options for Revising Hazardous Waste Identification
	enactment HWCL or RCRA		
Mercury-containing Legacy Mining Waste - Newly generated waste that originated from legacy waste would be subject to evaluation with mercury hazardous waste identification criteria (Ex. Recreational Gold Mining)	- Expected to be Hazardous - Exceeds TTLC	Subject to case by case evaluation under current CA mining exclusions and RCRA Bevill mining exclusion before waste may be evaluated for hazardous waste identification	Potentially
Non Excluded Bevill Mining Waste	- Exceeds TTLC - Expected to be Hazardous	Subject to case by case evaluation under current CA mining exclusions and RCRA Bevill mining exclusion before waste may be evaluated for hazardous waste identification	Potentially

* Based upon a biased data review of 136 waste classification requests from 1989 to 1999. The waste classification database is considered biased towards nonhazardous data since the requests are nonhazardous waste determinations, "reclassifications" or special waste classifications. It is not considered a representative sampling of wastes generated in California; however, the data is an indication of the potential impacts.

B. Hazardous Waste Identification Options

The hazardous waste identification options are:

1. Regulate all mercury-containing waste as a hazardous waste
2. Regulate all waste with intentionally added mercury as hazardous waste
3. Regulate all mercury-containing consumer products when they are discarded as hazardous waste
4. Develop a new hazardous waste regulatory threshold number
5. Status quo

1. Regulate All Mercury-Containing Waste as a Hazardous Waste

This option would regulate all mercury-containing waste, whether in a consumer product, dental amalgam fines entering the POTW, or naturally occurring such as in soils or rock (cinnabar), when removed from a site and disposed. This approach is similar to the federal "listed" waste. The simplistic concept of regulating all mercury-containing waste as listed in Table 6-1 has its merits. It is an easy regulatory threshold that is descriptive and for most wastes, requires very little analytical testing to determine if the waste contains mercury.

Pros

- Most protective criteria.

- Analytical testing to determine mercury concentrations is not necessary.
- Does not require the process of determining a new regulatory threshold through potentially controversial mismanagement scenarios and the use of risk assessment in those scenarios.
- Mobility and transformation of mercury is controlled through all potential sources of mercury, intentionally added (consumer products) and naturally occurring (cinnebar).

Cons:

- May seem overly protective at barely detectable concentrations of mercury, especially as technology's ability to detect lower concentrations of mercury in waste increases.
- Potentially large volumes of newly identified mercury-containing waste may impact Class I landfill disposal capacity.

2. Regulate All Waste with Intentionally Added Mercury as Hazardous Waste

This option would regulate all consumer products with intentionally added mercury, as well as mercury-contaminated soil (contaminated sites, spills with mercury), debris (wood debris with mercury in the latex paint), ash, sewage sludge, other industrial wastes.

This identification option is essentially the same as Option # 1, but does not include naturally occurring mercury. This presumes knowledge on the generator's part in that the generator must determine whether the mercury found in soils, ashes, sewage sludge was derived from naturally occurring mercury or consumer derived mercury since analytical testing cannot distinguish from naturally occurring and consumer derived mercury.

Pros:

- Analytical testing to determine mercury concentrations is not necessary.
- Does not require the process of determining a new regulatory threshold through potentially controversial mismanagement scenarios and the use of risk assessment in those scenarios.
- Will decrease potential capacity impacts to landfills from naturally occurring mercury in contaminated soil, ash, and sewage sludge.

Cons:

- May seem overly protective at barely detectable concentrations of mercury, especially as technology's ability to detect lower concentrations of mercury in waste increases.
- Naturally occurring and intentionally added mercury cannot be distinguished by laboratory analysis.
- Presumes that generator knowledge is present to make the distinction between naturally occurring and intentionally added mercury.
- Naturally occurring mercury wastes will continue to be a source of contamination.

This option does not offer any incremental benefit from Option # 1 and is not recommended as an approach to consider. Additionally, distinguishing between naturally occurring and intentionally added mercury in nonconsumer wastes cannot be shown with routine analytical laboratory testing, making compliance and enforcement difficult.

3. Regulate All Mercury-Containing Consumer Products when They Are Discarded As Hazardous Waste

This approach would regulate all consumer products with mercury at any concentration and would work with the current identification criteria, the STLC and TTLC. This approach would capture into the hazardous waste regulatory scheme all mercury-containing products, such as automobiles, which contain mercury components (mercury switches), which when the mercury concentration is distributed over the weight of the car, is "nonhazardous" under the current regulatory thresholds.

This approach would list newly identified hazardous waste as consumer products with mercury and would continue to identify nonconsumer products as hazardous waste under the current criteria. All other waste types, such as, ash, contaminated soils, sewage sludges, would continue to be compared to the current hazardous waste identification criteria, STLC and TTLC, and if shown to be nonhazardous, may be disposed (or otherwise managed) in an unlined Class III landfill or other approved use by other State or local agencies.

Pros:

- Analytical testing to determine mercury concentrations is not necessary.
- Does not require the process of determining a new regulatory threshold through potentially controversial mismanagement scenarios and the use of risk assessment in those scenarios.
- Little to no impact to Class I, II, and III landfill disposal capacities.
- Will encourage creative manufacturer pollution prevention and source reduction strategies by imposing hazardous waste management standards for mercury.

Cons:

- Potential of continued mercury contamination from nonhazardous, nonconsumer sources in the environment (ash, contaminated soil, waste water treatment waste).

4. Develop a New Hazardous Waste Regulatory Threshold Number

This option would require DTSC to develop new regulatory thresholds based on current science. The basis for current thresholds, the STLC and TTLC, would need to be re-examined.

The 1984 Statement of Reasons, which discusses the derivation and basis for the hazardous waste identification criteria, indicates that the current STLC and TTLC were

based on a starting point, the drinking water MCL. The mercury MCL was multiplied by an attenuation factor of 100 and yielded a STLC of 0.2 mg/L. The STLC was used as a starting point for the TTLC and was initially multiplied by an attenuation factor of 100 to yield 20 mg/kg. This initial TTLC concentration was compared to mercury concentrations found in soils in the Western United States, to concentrations found in the United States as a whole, and to concentrations found in unusually heavy mercury contamination. The TTLC of 20 mg/kg was found to be in within the median range of concentrations found and was promulgated as the mercury TTLC in 1984.

Since 1984 science has become more sophisticated in determining clean up levels and public health goals by using modeling and risk assessment, but these sophisticated methods, nevertheless, have their limitations. For instance, the most common route of mercury exposure to public is fish consumption. Determining a direct linkage to (un)acceptable mercury concentrations in waste upon disposal to the methylmercury bioaccumulation in fish is tenuous at best. Devising appropriate waste management and disposal scenarios to develop a new regulatory threshold would be subject to lengthy debate and controversy, simpler regulatory approaches, such as those listed above, may accomplish the same objective: (1) to encourage pollution prevention and recycling and (2) to prevent migration of mercury from mercury-containing waste into the environment.

Pros:

- A risk assessment modeling approach is a current scientific method to determine a clean up level and potentially, a hazardous waste threshold level.

Cons:

- Determining an appropriate (mis)management scenario may become subject to lengthy debate and controversy.
- Determining an appropriate long term deposition management scenario for mercury is controversial and subject to lengthy debate.
- Will delay addressing mercury emissions originating from waste.
- Will delay promotion of mercury recycling and pollution prevention through hazardous waste framework.

5. Status Quo

This option would make no changes to current regulations regarding mercury-containing waste. The STLC and TTLC would stay the same.

Pros:

- No impacts to existing structure.

Cons:

- Does not support national and state efforts to reduce mercury emissions into the environment.

- Does not encourage recycling or pollution prevention of mercury-containing waste by potentially imposing hazardous waste regulations when recycling options are available**.**

IV. Hazardous Waste Management Options

A. Waste Types and Product Estimated Volumes and Capacities
Upon identifying additional mercury-containing waste as hazardous waste, recycling may be required for that waste, where recycling technology and capacity exists. This option could be pursued under reduced hazardous waste management requirements through Universal Waste regulations. Pollution prevention, using mercury alternatives, will be encouraged, as generators will consider the impact of using mercury-containing products with their associated "cradle to grave" liability. Other management options that may be considered are: (1) prescriptive or performance management standards for specific waste streams and (2) a phased implementation schedule to allow transition to the use of mercury alternatives, infrastructure development to facilitate collection and recycling of mercury-containing waste or products, or for other reasons, such as development of additional recycling technologies or capacity.

The criteria that DTSC could consider in relation to hazardous waste management options in addition to the information presented in this report are volumes affected, recycling capacity and disposal capacity.

Table 6-2, Waste Types / Product Estimated Volumes and Capacities, takes those waste identified in Table 6-1 that are affected by regulating additional mercury-containing wastes and estimates volumes affected and the recycling capacity. The information contained in Table 6-2 will be used to determine the hazardous waste management options.

Table 6-2 Waste Types / Product Estimated Volumes and Capacities

Waste Type/Consumer product	Estimated Volumes	Recycling Capacity
"Nonhazardous" Mercury Lamps	Need Data (Anecdotal information that 25% of tubes disposed are "nonhazardous" lamps)	Available
Toys, Games, Novelty Items and other Items which contain encased Mercury Switches	Need Data Information not available in SB 633, which bans the sale of these items in CA.	Available if mercury switch or battery removal is assessable
Other Mercury Measuring instruments (barometers, manometers, etc.)	Need Data National data unavailable	Available, if mercury removal is assessable
Mercury-painted debris	Need Data	None
Automobiles with Mercury Switches	700,000 autos/year that are shredded in California*	Available
Appliances ("White Goods") with Mercury Switches	Need Data	

Waste Type/Consumer product	Estimated Volumes	Recycling Capacity
Auto Shredder Waste (a mixture of white good and automobile waste after metal recovery)	300,000 short tons/year*	No – ASW Available, if mercury switch is removed
Ash	Need Data on "nonhazardous" ash 15,700 tons in 1999 20,700 tons in 2000 Hazardous waste volumes**	No
Sewage Sludge	Need Data on "nonhazardous" sewage sludge 9 tons in 1999 1400 tons in 2000 Hazardous waste volumes**	No
Contaminated Soil	Need Data on "nonhazardous" contaminated soil 647,000 tons in 2000 419,000 tons in 1999 Hazardous waste volumes**	No
Waste containing Legacy Mining Waste - Newly generated waste that originated from legacy waste would be subject to evaluation with mercury hazardous waste identification criteria (Ex. Recreational Gold Mining)	Need Data – potentially affected	Available for recovered mercury during mining operations
Non Excluded Mining Waste		

* Source: DTSC Auto Shredder Initiative
** Source: DTSC Haznet Database

B. Hazardous Waste Management Options

DTSC has various options to regulate mercury. The following is a discussion of these options. DTSC may choose to use a combination of options depending on the mercury waste stream and the availability of a collection and recycling infrastructure.

1. Universal Waste Management

There are many options under Universal Waste management. Developing Universal Waste management standards may be as flexible (performance standards) or as specific (prescriptive standards) as the waste stream impacts dictate. Universal Waste management standards would streamline the requirements for collection and management of common hazardous wastes designated as universal wastes without posing an additional risk to public health and the environment.

Pros:

- Would promote pollution prevention and encourage recycling by reducing hazardous waste management standards under Universal Waste for consumer product discards for which there is a valued economic use (ex. energy saving lamps) or no mercury alternatives.

- Would promote recycling under reduced hazardous waste management requirements under Universal Waste regulations for mercury-containing waste or potentially be subject to full hazardous waste management standards.
- Would encourage pollution prevention by encouraging generators to find viable alternatives for mercury-containing consumer products.
- Would encourage creative manufacturer pollution prevention and source reduction strategies by imposing hazardous waste management standards for mercury-containing products.
- Would allow flexibility within the hazardous waste management standards by considering waste stream specific needs.

Cons:

- Recycling technologies may not exist for all waste types or products.
- Some waste types may still be subject to full hazardous waste management standards due to risks posed under reduced management standards.

2. Hazardous Waste Management

This management option would subject all newly identified mercury-containing hazardous waste to full hazardous waste management standards, including storage time limitations, manifesting, use of a registered hauler for transportation, permits, and disposal.

Pros:

- Would provide the highest level of protection to the environment.
- Requires no changes to existing regulatory structures for hazardous waste management.
- Environmental protection may be achieved immediately since phased implementation will potentially not be necessary.
- Would encourage creative manufacturer pollution prevention and source reduction strategies by imposing hazardous waste management standards for mercury-containing products.

Cons:

- Would not provide an incentive to recycle and may encourage land disposal.

3. Phased Implementation

Phasing implementation of the hazardous waste management options may be considered for certain generators to promote pollution prevention by using mercury alternatives. DTSC may consider generators, such as householders and small quantity generators, for this management option. Phased in approaches may also be considered for contaminated soils, ashes, or sewage sludge based on disposal or recycling capacities. Some management options, such as recycling as Universal Waste, may benefit from a phased implementation schedule to allow time to develop an infrastructure.

Pros:

- Would allow time to comply with management standards for newly identified hazardous waste.
- Would allow time to substitute mercury-containing products with mercury alternatives.
- Would allow time for recycling technologies and/or capacities to be developed.
- Would allow time to develop an infrastructure to ensure compliance with management standards for newly identified hazardous waste.

Cons:

- Mercury-containing waste would continue to contribute to the mercury environmental burden until compliance dates are effective.

4. Landfill Disposal - Class I

Wastes that are not recycled would be land disposed. Land disposal of mercury-containing waste would be in a Class I landfill rather than a Class II or III landfill. Class I landfill disposal was determined the most protective due to the following factors:

(1) Mercury mobility is most stable in land, where it was once mined.
(2) A recent municipal landfill study by Lindberg, et al., has shown that mercury compounds have been detected in landfill gas, indicating that mercury disposed in a municipal landfill has the potential to liberate mercury into the atmosphere and redeposit onto land or water.[4] Landfill gas is not generated in a Class I landfill since there are no volatile organics or putrescible waste disposed in a Class I landfill.
(3) Mercury has been detected in municipal landfill leachate, which may migrate and contaminate water sources.[5]
(4) Leachate collection systems, such as those in Class I landfills, will control migration of leachable mercury into the environment.[6]

Pros

- Most protective.
- Class I landfills have protective liners and leachate collection systems.
- Class I landfill environments do not actively produce landfill gas.

Cons

- Potentially large volumes of newly identified mercury-containing waste may fill Class I landfill disposal capacity.

5. Landfill Disposal - Class I, II, or III

This disposal option would allow all mercury-containing wastes that are not recycled to be disposed in a lined landfill with leachate collection system, that is, a Class I, II or upgraded, lined Class III landfill. The current mercury criteria, the STLC and TTLC, would continue to determine Class I disposal. Mercury-containing wastes that did not

exceed the STLC or TTLC could be disposed in Class II or upgraded, lined Class III landfills as well as a Class I landfill. The disposal options available for mercury-containing wastes that do not exceed the STLC or TTLC would allow generators to optimize their choices for a management and disposal strategy suited to their needs.

Disposal of mercury-containing wastes to lined Class II or III landfills with leachate collection systems would mirror aspects of current asbestos-containing waste disposal to Class II or III landfills. High volume wastes, such as ashes, sewage sludge, and contaminated soils, which are newly identified hazardous waste (do not exceed the STLC or TTLC) and whose only management option is landfill disposal, might benefit from the disposal option choices.

Pros:

- Would place mercury-containing waste in a protective landfill environment that will collect landfill leachate.
- Would optimize generator management options for disposal.
- High volume wastes, which do not exceed the STLC or TTLC, might benefit from this option.

Cons:

- Would require revising statutory authority for Class II and Class III landfills to accept newly identified mercury-containing hazardous waste.
- There may be strong opposition to allow a new "hazardous waste" into upgraded, lined Class III landfills.
- Class II and Class III landfill permits and waste discharge requirements would have to be revised.
- Atmospheric mercury would potentially be released from these upgraded Class III landfills, even with landfill gas collection systems.
- Would require analytical testing for mercury concentrations to determine appropriate landfill disposal option. [7]

V. Options Limitations

Due to a lack of information, DTSC was not able to fully consider the impact of the volumes of newly identified mercury-containing waste and their subsequent impacts to recycling and disposal capacity. Data is needed to complete DTSC's evaluation to recommend a hazardous waste identification approach and management option(s). DTSC is requesting this data through the public workshops that will be held.

VI. Recommendation

Hazardous waste identification Option # 1 is recommended as being the most protective to identify and regulate mercury-containing waste. Universal waste management, Class

I disposal and phased implementation are recommended as hazardous waste management options.

Section 6 Key Points:

- To encourage pollution prevention and recycling, DTSC is considering recommending that all mercury-containing waste, considered nonhazardous under current hazardous waste identification criteria, be considered hazardous waste.
- DTSC is considering recommending "listing" all mercury-containing waste, regardless of source, as hazardous waste; the use of universal waste management standards for waste type or product where they are most applicable; Class I landfill disposal; and phased implementation to allow time for any needed infrastructure development and compliance.
- Additional data is needed to consider the impacts newly identified hazardous wastes to recycling and disposal capacity.
- Hazardous waste identification options considered are variations of "listing" mercury-containing waste.
- Hazardous waste management options considered include applying universal waste management scheme where applicable, full hazardous waste management standards, disposal in a Class I landfill, and phased implementation.

Endnotes

[1] Office of Environmental Health Hazard Assessment (OEHHA), 1999. California Sport Fish Consumption Advisories 1999. p. 7.

[2] Lindberg, S.E., Wallschläger, D., Prestbo, E.M., Bloom, N.S., Price, J., and Reinhart, D., 2001. Methylated mercury species in municipal waste landfill gas sampled in Florida, USA. Atmospheric Environment, Vol. 35. pp. 4011-4015.

[3] Frampton, James A., 1998. Leaching Potential of Persistent and Bioaccumulative Toxic Substances in Municipal Solid Waste Landfills. Department of Toxic Substances Control, Human and Ecological Risk Division. p. 3-11, Table 3-6.

[4] Lindberg. et al, 2001. pp. 4011-4015.

[5] Frampton, 1998. p. 3-11, Table 3-6.

[6] Title 22, California Code of Regulations.

Appendix A
Summary of Nationwide Mercury Efforts

This appendix is a compilation of nationwide efforts regarding mercury as they apply to products, bans or restrictions on mercury-containing products, any state laws or regulations specific to mercury, mercury-containing waste and voluntary and other efforts of interest. It is not to be considered a comprehensive compilation of all applicable state laws and regulations regarding mercury; but is a summary of efforts of interest to this report. Sources to compile this summary were the states' websites with follow up telephone calls to states for clarification or additional information.

	Statutes / Regulations	**Proposed Legislation**	**Other Efforts**
AR		• None	• Pamphlets/brochures describing mercury problem. • Fish consumption advisory pamphlets. • Television public service announcements. • Fish flesh monitoring program.
CA	• Prohibited sale of Zinc Carbon, Alkaline Manganese batteries, and Alkaline batteries greater than .025% mercury by weight. • Prohibited sale of mercuric oxide batteries • Prohibited manufacturing, exchange, and sale of toys containing soluble compounds of mercury.	• SB 633 would prohibit any person from selling or supplying mercury fever thermometer except by prescription. Prohibits manufacturing, sale, or distribution of mercury-added novelties. Prohibits any school form purchasing specified materials and devices containing mercury. Encourages but does not mandate the removal of mercury-containing switches from vehicles, once removed switches must be managed as hazardous waste, and prohibits the sale of vehicles manufactured on or after January 1, 2005 that contains a mercury-containing motor vehicle light switch.	• Guide to Mercury Assessment and Elimination in Healthcare Facilities. • Fish consumption advisories printed in the California Sport Fishing Regulations booklet and updated by OEHHA.
CT	• Adopted .028 mg/dscm emission limitation for municipal waste incinerators. • Mercury-containing lamps added to Universal Wastes.	• HB 5179 bans sale of mercury thermometers. • HB 5181 discourages disposal of mercury-containing products. • HB 6197 would regulate mercury products and mercury emissions. • HB 6687 restricts the sale of products with mercury.	• Commercials on mercury and thermometer exchanges. • Goal of 2001 pounds of mercury collected by end of year 2001. • Conducted fish tissue monitoring from 1995 to 1999. • 3 years of atmospheric mercury monitoring. • Study sources and cycling of mercury in

	Statutes / Regulations	Proposed Legislation	Other Efforts
		• SB 701 is known as Omnibus Mercury Reduction Act.	Long Island Sound.
DE	• Surface Water Quality Standards specify criteria for human health as well as protection of aquatic life.	• None	• Delaware 2000 Fishing Guide lists fish consumption advisories.
FL	• Mercury-containing electrical devices such as thermostats, mercury switches, relays, thermometers, manometers, ampoules, and lamps are prohibited from being disposed of in landfills or incinerated, does not include batteries or lights. • Separated glass from mercury-containing lamps may not be incinerated or used in food and beverage containers.	• None	
GA	• Regulates air releases from sewage sludge, medical waste, municipal incinerators and one chlor-alkali plant. • "Risk reduction" standards created for superfund sites soil and water. • Water Protection Branch has health based water quality criteria and permits for several industries.	• None	• Fish consumption guidelines released each year and posted on EPD website (www.ganet.org/dnr).
IL		• None	• Has ongoing education outreach about fish advisories to women of childbearing age throughout the state
IN	• HB1901 Prohibits the sale and distribution of most mercury-added novelties. Limits circumstances under which mercury fever thermometers may be sold or supplied to individuals. Restricts public and nonpublic school from using or purchasing a mercury commodity, mercury compounds, or mercury-added instructional equipment and materials. Provides that a person may sell or provide a	• HEA 1967 would ban mercury thermometers and novelties. Would also prohibit the use of elemental mercury in schools.	• Outreach programs as well as exchanges have taken place in the past. There has also been free mercury recycling programs in the past

	Statutes / Regulations	Proposed Legislation	Other Efforts
	mercury commodity to another person only if the person meets certain conditions. All of the preceeding are effective July 1, 2003. Requires implementation of mercury education programs.		
KS		• None	• Provides information pamphlet on mercury spills. Free mercury collection days allow people to bring mercury to a site for free recycling.
KY	• No state air pollution standards for mercury. • Wastewater discharge limits based on water quality criteria.	• None	• Pollution prevention training for Health Care Providers including recycling. • Pollution prevention training includes handling of fluorescent bulbs and thermostats to prevent mercury loss. • Business and household recycling programs for mercury batteries.
LA	• If detected in waste stream a limit is developed and included in permit. • Air emissions modeled against state ambient standards.	• None	• LDEQ's website contains information on fish advisories, health concerns, some sources of mercury and a pointer to the Mercury Deposition Network.
ME	• Manufacturers required to label some mercury-added products stating the product may not be placed in the trash. • Disposal of specified products is banned including non-residential fluorescent lamps after July 2002 and household lamp products by 2005. • Air emissions limited to less than 100 pounds per year after January 1, 2000 and not more than 50 pounds per year after January 1, 2004. • HP 1224 reduces mercury emissions from consumer products and requires manufacturers to provide written notice before offering mercury-added products for sale. Ban on mercury	• LD 1409 called "An Act to Address The Health Effects of Mercury Fillings" was signed on June 12th, 2001.	• Mercury-added products are targeted under a program for collecting household hazardous waste. • Developing a source reduction program for dental procedures. • Replacing mercury manometers from dairy barns and replacing with non-mercury at no cost to the farmer. • Working with health care providers to reduce mercury-added instruments and products being used.

	Statutes / Regulations	Proposed Legislation	Other Efforts
	thermometers. Prohibits schools from purchasing mercury or mercury compounds. Manufacturers must provide a certificate of mercury content to hospitals upon request.		
MD	• HB 75 prohibits selling or distributing mercury fever thermometers except under specified circumstances beginning October 1, 2002. • Prohibits primary and secondary schools from purchasing elemental or chemical mercury beginning October 1, 2003. • Department of the Environment required to provide outreach to schools on proper management recycling, and disposal of mercury and mercury-added products	• None	•
MA	• NEG and ECP Mercury Action Plan calls for elimination of mercury emissions with 50% reduction by 2003. • 1999 adopted emission limit of 28ug of mercury per dry standard cubic meter for Municipal Solid Waste Combustors.	• HB 1555 Bans the use of mercury in public schools • HB 2217 Restricts sale and use of products containing mercury • HB 3772 Regulates the sale of mercury thermometers • Considering an emissions limit of 28ug per dry standard cubic meter for Medical Waste Incinerators.	• Collection of bulk elemental mercury from dental offices. • Mercury thermometer collection and replacement project. • Municipal Assistance Program includes subsidized statewide contract to reduce the costs of pickup and recycling. • Outreach to dentists, fisherpeople, and pregnant women. • Other projects including “clean sweep”
MI	• 1999-2000 legislation to phase out mercury use in school classrooms by 2004. • Permits required for discharge directly to waters of the state. • Adopted Universal Waste rule in 1996 for batteries, thermostats, switches, thermometers, and any waste device containing only mercury as the hazardous waste constitute	• HB 4599 prohibits the sale of mercury thermometers. • SB 6 requires hospitals to not use mercury after December 31st, 2005 unless no mercury-free alternatives are available.	• Many mercury pollution prevention activities have been implemented • University of Michigan received 1.3 million dollars in 1996 to conduct mercury-monitoring program in the Lake Superior Basin. • 1998 citizens passed the Clean Michigan Initiative, a $ 675 million bond to clean up, protect, and enhance Michigan’s environmental quality that included mercury assessment activities such as collecting and

	Statutes / Regulations	Proposed Legislation	Other Efforts
			analyzing Bald Eagle blood and feather samples for mercury and other bioaccumulative chemicals.
MN	• Disposal of mercury containing thermostat, thermometer, electrical switch, appliance, gauge, medical or scientific instrument, or electrical relay into solid waste or wastewater system is prohibited • A person may not sell mercury to another person without providing a material safety data sheet and having signed statement. • Manufacturer may not sell thermostat, thermometer, electrical switch, appliance, medical or scientific instrument, or electrical relay without labeling clearly that the product may not be placed in the garbage until the mercury is removed and managed to ensure it does not become part of the waste. • Toys, games, apparel, and manometers are banned.	• HF 274 and SF 70 prohibit the sale of mercury thermometers.	• Developed a web site 2 years ago after the Mercury Contamination Reduction Initiative. • Developing TMDLs for two watersheds. • Minnesota will continue to research environmental effects of mercury
MO	• 1995 adopted emission standards for medical infectious waste incinerators.	• None	• Maintained efforts to monitor for mercury but has not increased its efforts.
NE		• LB 40 prohibits the sale of mercury thermometers.	
NH	• Set emissions limit of 0.028 mg/dscm for municipal waste incinerators. • Banned mercury thermometer sale without prescription. • Banned sale of novelty items • Prohibits mercury use in k-12 classes. • Restricts sale of elemental mercury	• HB 655 Establishes advanced disposal fee to fund local mercury presorting and recycling programs. • HB 675 Covered the reduction of mercury in products.	• Mercury reduction workshops for hospitals. • Developing mercury collection and recycling program with NH Dental Society. • Established a contract to collect and recycle all the state agencies fluorescent lamps. • Ecowatch television commercial describing the hazardous nature of mercury and proper management. • Promoted thermometer exchange program.

	Statutes / Regulations	Proposed Legislation	Other Efforts
	to a few specific purposes. • Manufacturers of mercury-added products, such as fluorescent lamps, batteries, thermostats, and electrical switches must notify the state about how much mercury is contained in their products. • Banned disposal of mercury oxide batteries.		• Collection and sampling of freshwater fish.
NJ	• Banned the sale of consumer mercury oxide batteries. • Limits mercury emissions to 28ug/dscm from municipal solid waste incinerators	• A 3250 and S 2315 both ban the sale of mercury thermometers.	• Universal Waste Rule for fluorescent lamps, mercury switches, gas regulators, and thermometers. • Funding for demonstration projects to collect and recycle mercury-containing products. • Distribution of 10,000 copies of "A Woman's Guide to Eating Fish and Seafood" to NJ health clinics. • Numerous research projects.
NM	• No discharge of mercury to landfills	• None	• Fish tissue studies. • Monitoring of known mercury sources such as abandoned mines.
NY	• Pretreatment and source control programs. • Adopted federal emission limits for medical waste incinerators and municipal waste combustors. • Limit of 10ppm for land application of sludge and compost.	• AB 4209 and SB 3084 are the same bill that would phase-out mercury-added products. They include disposal prohibition, labeling requirements, source separation, requirements for sewage treatment plants, point source release containment traps, and ban the sale of certain products. Also require the replacement of manometers and gas pressure regulators, regulates dental use and bans health insurance discrimination, requires lamp recycling, and adds all mercury-added products to state universal waste rules.	• Mercury-containing batteries, fluorescent lamps and other mercury-containing products are included in many household hazardous waste collection programs. • Several research and monitoring programs are in place mercury as well as other chemicals
NC	• Air emissions and water discharges are limited	• None	• Fish consumption advisories posted at boat launches. • Pamphlets explaining risk of consuming contaminated fish are distributed with fishing

	Statutes / Regulations	Proposed Legislation	Other Efforts
			licenses. • Research to identify and characterize North Carolina impaired waters.
OH	• MACT Program and permit system to assure compliance with Federal mandates.	• None	• Bulk mercury collection program for dental offices and education efforts. • Other mercury reduction projects are being created. • Monitoring efforts includes a plan to collect ambient mercury data in the south Great Lakes area.
OR	• 2001 HB 3007 passed and was signed into law. Prohibits sale of mercury thermostats, fever thermometers, mercury-added novelties and motor vehicles containing mercury light switches. Prohibits installation of mercury thermostats with exception. Calls for removal of all mercury light switches from state-owned vehicles.	• SB 903 Creates task force to conduct or sponsor research to address possession of hazardous substances, including mercury waste.	•
RI	• 2000 established a 0.055 milligrams per dry standard cubic meter emission rate for hospital, medical, and infectious waste incinerators. • 2001 SB 153 banned the sale of mercury containing fever thermometers except with a prescription.	• HB 6161 and SB 661 prohibit landfill disposal of mercury and provide for the collection and proper handling of mercury. • SB 649 encourages establishment of effective waste reduction, recycling, management, and education programs.	• Thermostat recycling take-back programs. • Fish advisories issued through the Department of Health (www.health.state.ri.us/000406a.htm)
SC	• Water quality standards for mercury in streams	• None	• Fish consumption advisory information issued annually. • Collect and analyze a minimum of 1500 fish samples a year.
SD	• Surface water discharge permits.	• None	• Bitter Lake Fish Consumption Advisory. • Research on ambient surface water quality near mining point sources.
TE		• None	• Water and fish tissue monitoring have been practiced. • Fish advisories limiting consumption or in

	Statutes / Regulations	Proposed Legislation	Other Efforts
			some cases “do not consume” advisories are issued when needed
TX	• Regulatory efforts in Texas include standards for drinking water, surface water, land application, and risk reduction	• HB 3085 regulates the sale and use of products containing mercury.	• Collection and recycling programs. Online guide to businesses that handle mercury. • Wastewater pretreatment assistance. • Various research projects and programs
VT	• Manufacturers and wholesalers may not sell mercury containing thermometer, thermostat, medical instrument, scientific instrument, switch, lamp, or battery unless it is labeled as a mercury-added product (1999). • Labeled mercury-added consumer products prohibited from being disposed of in solid waste landfills. • Advisory committee on mercury pollution formed.	• HB 283 Establishes advanced disposal fee for certain mercury-added products (8% of wholesale price) • SB 91 Bans sale of thermometers, dairy manometers, and novelties with mercury. Bans some uses of mercury in schools and the disposal of mercury in landfills and incinerators. Requires separation of mercury containing products prior to disposal or recycling. Requires manufacturers to report the amount of mercury in products.	• Laboratory chemical clean outs. • Voluntary pledge programs for pharmacies to not sell mercury thermometers. • Mercury thermometer exchange program. • Training for reduction of mercury-added hospital products. • Consumption advisories on fresh and salt waster fish.
VA		• None	• Dental mercury sweep collection and recycling. • School sweep collection and phase out.
WI	• Surface water criterion. • Emissions	• NR 446 limits mercury emissions from coal burning plants and industrial operations that have mercury emissions of more than 10 pounds a year. 90% reduction over 15 years. • A bill reducing mercury in products is also being drafted.	• Thermostat exchanges. • School collections. • Dairy manometer exchange program. • Mercury reduction workshops • Numerous monitoring efforts are used
US	• HR 2024/Public Law No. 104-142 banned the sale of zinc carbon, mercury-oxide, and alkaline-manganese batteries with intentionally introduced mercury. Also banned the sale of Alkaline-Manganese button batteries containing more than 25 milligrams per button battery.	• S 351 bans sale of mercury fever thermometers and sets up a task force to research the collection and permanent retirement of mercury. • S 555 requires the Secretary of Health and Human Services to establish a tolerance for the presence of methylmercury in seafood. • HR 2266 reduces risk of accidental release of mercury into the environment by providing temporary storage of private	

	Statutes / Regulations	Proposed Legislation	Other Efforts
		sector mercury supplies at facilities of the Department of Defense that are currently used for mercury storage. It also requires the Administrator of the Environmental Protection Agency to appoint a task force to develop a plan for the safe disposal of mercury.	

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